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American Potato Journal

Volume 24 DECEMBER, 1947 Number 12

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PUBLISHED MONTHLY AT

THE POTATO ASSOCIATION OF AMERICA

New Brunswick, New Jersey

Subscription Price $2.00 Per Year

Entered as second class matter at New Brunswick, N. J., March 14, 1942, under Act of March 3, 1879.

Accepted for mailing at special rate of postage provided for in section 412. Act of February 28, 1925, authorized on March 14, 1928.

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American Potato Journal

PUBLISHED BY

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NEW BRUNSWICK, N. J.

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EFFECT OF BORON IN FERTILIZER UPON QUALITY OF DEHYDRATED WHITE POTATOES

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INTRODUCTION

The physiological effects of boron on the growth and development of plants have been the subject of very extensive studies by American investigators during the last 30 years. The toxic properties of boron and its compounds were the first to receive attention because stoppage of importation of potash during World War I led to the employment in commercial fertilizers of potash salts of American origin, which contained varying but usually considerable quantities of borax (sodium borate, $Na_2B_4O_7$) as an impurity. The application of such fertilizers resulted in widespread injury to various crops, varying from reduction in vigor and yield to complete failure to develop. Studies of the cause of the injury undertaken by numerous investigators very quickly showed conclusively that it was attributable to the presence of borax in the fertilizer, and it was demonstrated that definite damage to a wide

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variety of crop plants resulted from applications of borax as low as 3 to 10 pounds per acre (4,5,3,12,10).

In the case of the potato (2, 13, 11, 1) it was shown that there was somewhat greater tolerance of borax than in the case of beans, corn, and some other crops. It was also found that with potatoes amounts too small to produce injury were beneficial, stimulating growth of tops and thus possibly increasing yields. Brown (2), for example, found that 1 to 3 pounds of borax per acre applied in the furrow, or 4 to 5 pounds broadcast at the time of planting potatoes, gave an increase in yields, whereas 10 pounds or more resulted in definite lowering of yield, regardless of the method of application.

The general result of these and other investigations carried out during the period 1916 to 1922 was that the presence of borax in any amount in a fertilizer came to be generally regarded as harmful, and fertilizer manufacturers accordingly took steps to reduce the amounts present in their products to mere traces. Boron injury to crops thereupon practically ceased to occur.

As an increasing number of workers have taken up the study of the functions and physiological roles of the minor or trace elements in plant nutrition, boron again became the subject of intensive investigation, and it has been said that its effects have been more extensively studied in recent years than those of any other element (9). This more recent work has confirmed the results of the earlier investigators in showing the highly toxic effect upon plants generally of boron in excess of a very small quantity, which varies somewhat with the type of plant, the climatic conditions, and other factors. It has also shown that the presence of boron in amounts below the toxic level is essential to the normal growth and development of plants, and that a deficiency of boron in the soil or nutrient solution results in characteristic symptoms of boron starvation. Boron deficiency is especially apt to occur in soils high in calcium content, as a certain balance between calcium and boron in the plant is necessary to normal development.

In the potato, very severe interference with growth of both tops and roots, wholly preventing tuber formation, has been reported for plants grown in completely boron-free nutrient solutions or sand cultures. In the field, boron-deficiency symptoms are confined chiefly to the tubers, and effects upon vines, if they appear at all, are apparent only late in the season. As summarized by Jones and Brown in 1941 (7), the injury to tubers consists in reduction in size and brown discoloration of the flesh, especially at the stem end. Smith and Nash

(14) stated that potatoes grown without boron were deficient or flat in flavor, very wet, and sloughed badly in boiling, but blackening did not occur in the variety used (Smooth Rural). Workers at the Vermont Agricultural Experiment Station (6) reported severe dwarfing, wateriness, and generalized internal browning in tubers of boron-deficient plants, with susceptibility to early blight, which did not attack checks receiving boron.

The results of these and similar investigations have led to the systematic addition by a number of manufacturers of small, definitely measured amounts of boron, usually in the form of sodium borate, to commercial fertilizers designed for use upon truck crops or potatoes. While it is quite generally agreed that such additions are beneficial for a number of vegetables under certain conditions, opinion does not appear to be unanimous as to their effects in the case of potatoes. Whether small applications of boron decrease the tendency of potatoes to darken in cooking has also been the subject of considerable discussion.

Purpose and Scope of the Present Work

In the present work a comparison is made between the dehydrated products made from potatoes of the same varieties, grown side-by-side upon the same soils, with and without the addition of boron to the fertilizer applied.

The potatoes employed consisted of U. S. No. 1 stock of the varieties Katahdin and Green Mountain grown in a field test of effects of fertilizer with added boron *versus* no boron, conducted in Aroostook County, Maine, by the Summers Fertilizer Company, Inc., of Baltimore, Md. They were supplied for the study by courtesy of J. E. Totman, president of that company, to whom the writers desire to express their appreciation for the opportunity to carry out the present study. The material of each variety consisted of stock grown on each of four farms differing only slightly in their levels of fertility; that from each farm consisted of two lots of several hundred pounds each, one grown with and the other without boron added to the fertilizer used.

The fertilizer applied to the plots receiving no boron was a 5-7-10 formula, of which 2,500 pounds per acre were applied at planting as side bands 2 inches from the seed. The fertilizer containing boron was a 6-9-15 formula to which sodium borate had been added at the rate of 10 pounds per ton. This was applied at the rate of 1,500 pounds per acre at the same time and in the same manner as the other

fertilizer. It may be noted that the two fertilizers differed considerably in other respects than in presence or absence of boron. The no-boron treatment supplied 125 pounds of nitrogen, 175 of potash (K_2O) and 250 of phosphoric acid in comparison with 90, 135, and 225 pounds, respectively, of these nutrients in the boron-containing fertilizer. The amount of sodium borate applied per acre was 7½ pounds.

Participation of the writers in the experiment was limited to work with mature potatoes supplied them by shipment to Beltsville after harvest. One of the writers saw the plantings in midseason. The plots were all uniformly Caribou loam of moderate productiveness and were of considereable size, occupying several acres on each of the four farms. No differences in growth and vigor of the plants under the two treatments were detectable in midseason. The writers are informed that although no exact yield data were taken, no significant differences in yields between treatments were observed at harvest. They are also informed that it was the belief of a dehydrator operator* in the area that the product made from Green Mountain potatoes receiving added boron in the fertilizer was upon the whole somewhat better than that made from the same variety receiving no boron.

The various lots of the variety Katahdin were assembled and shipped to Beltsville, Maryland, within a few days after they were dug; the material of Green Mountain was held in storage at Presque Isle, Maine, for about 2 weeks prior to shipment. Upon receipt at Beltsville, each shipment was held in storage at 60° F. for approximately 3 weeks after which portions of each lot were dehydrated, as described in the next section. The dehydration of Katahdin was carried out on the 1st of December and that of Green Mountain on the 18th of December, 1944. The remaining material was held in storage at 60° until the 16th to 18th of February, when it also was dehydrated.

A careful comparison of the various lots of boron-treated potatoes with the check lots receiving no boron was made prior to and during the preparation for drying in December and repeated with the material dried in February. There were no discoverable differences between the potatoes from the two fertilizer treatments in smoothness, surface cracking, stem-end browning, net necrosis, presence of decay, or other respects.

Preparation and Drying of the Material

All material was inspected before peeling, and any visibly decayed tubers were removed and weighed. The sound stock was then

*Summers Fertilizer Co., at their dehydrating plant at Winterport, Maine.

TABLE I.—*Condition of raw stock, losses in peeling and trimming, and yields of dry product as percentages of whole*

TABLE 1.—*Condition of raw stock, losses in peeling and trimming, and yields of dry product as percentages of whole tubers for Katahdin and Green Mountain potatoes grown in four locations with and without application of boron to the soil.*

Variety	Grower	Fertilizer	Date Dehydrated	Percentage Discarded For Rot	Percentage Showing Net Necrosis etc.	Percentage Peeling loss	Percentage Trimming loss	Percentage Prepared Strips	Yield of Dry Product As Percent Fresh Whole Stock	Yield of Dry Product As Percent Prepared Strips
Katahdin	Brogdon	No Boron	Dec. 1,'44	Less than 1	0	15.0	3.0	82.0	15.0	18.3
		Boron	Dec. 1,'44	Less than 1	0	13.5	2.6	83.9	15.9	18.9
	Coates	No Boron	Dec. 1,'44	Less than 1	0	14.2	4.5	81.3	14.9	18.3
		Boron	Dec. 1,'44	Less than 1	0	14.6	4.6	80.8	14.4	17.8
	Davis	No Boron	Dec. 1,'44	Less than 1	0	19.0	4.4	76.6	15.4	20.1
		Boron	Dec. 1,'44	Less than 1	0	12.9	5.8	81.3	16.0	19.6
	Hewitt	No Boron	Dec. 1,'44	Less than 1	0	17.4	2.9	79.7	14.2	17.8
		Boron	Dec. 1,'44	Less than 1	0	19.4	3.3	77.3	13.9	17.9
Katahdin	Brogdon	No Boron	Feb.16,'45	Less than 1*	0	17.4	4.3	78.3	14.3	18.2
		Boron	Feb.16,'45	0*	0	17.2	3.8	79.0	16.2	20.5
	Coates	No Boron	Feb.16,'45	2*	0	16.0	4.7	79.3	14.7	18.5
		Boron	Feb.16,'45	1	0	19.8	4.3	75.9	14.4	18.9
	Davis	No Boron	Feb.16,'45	0	0	23.8	2.8	73.4	13.1	17.8
		Boron	Feb.16,'45	4	0	16.1	7.6	76.3	14.8	19.4
	Hewitt	No Boron	Feb.16,'45	0*	0	22.0	2.5	75.5	13.6	18.0
		Boron	Feb.16,'45	1	0	15.3	4.8	79.9	16.4	20.5
Green Mountain	Brogdon	No Boron	Dec.18,'44	Less than 1	Less than 1	16.0	8.9	75.1	17.4	23.1
		Boron	Dec.19,'44	Less than 1	Less than 1	15.6	6.0	79.0	17.2	21.7
	Coates	No Boron	Dec.18,'44	Less than 1	Less than 1	13.6	6.6	79.8	17.0	21.3
		Boron	Dec.19,'44	Less than 1	Less than 1	18.9	10.1	70.0	13.6	19.4
	Davis	No Boron	Dec.18,'44	Less than 1	Less than 1	15.5	6.8	77.7	14.0	18.1
		Boron	Dec.19,'44	Less than 1	Less than 1	11.6	5.4	83.0	15.8	19.0
	Hewitt	No Boron	Dec.19,'44	Less than 1	Less than 1	17.3	5.5	77.2	15.2	19.7
		Boron	Dec.19,'44	Less than 1	Less than 1	16.3	7.2	76.7	15.5	20.2
Green Mountain	Brogdon	No Boron	Feb.17,'45	0	2	24.0	7.3	68.7	16.2	23.5
		Boron	Feb.17,'45	5	1	18.6	10.6	70.8	15.9	22.4
	Coates	No Boron	Feb.17,'45	Less than 1	3	14.3	8.5	77.2	17.6	22.8
		Boron	Feb.17,'45	2	4	14.2	11.7	74.1	16.9	22.8
	Davis	No Boron	Feb.17,'45	10	8	21.8	15.4	62.8	13.1	20.8
		Boron	Feb.17,'45	8	10	20.2	15.7	64.1	13.7	21.3
	Hewitt	No Boron	Feb.17,'45	Less than 1	Less than 1	16.3	7.3	76.4	15.3	20.0
		Boron	Feb.17,'45	6	3	18.0	9.4	72.6	15.4	21.2

* These lots were free of rot but considerable sprouting had occurred.

weighed, peeled by immersion in boiling lye solution of 8- to 10-per cent strength, thoroughly washed to remove lye, and placed in containers of cold 1-per cent sodium chloride (common salt) solution. After inspection and trimming, the potatoes were cut by a stripping machine into random-length julienne strips three-eighths by three-eighths inch in cross section. As cut, the strips were received into a 1-per cent salt solution, again inspected, and any diseased or partially diseased pieces removed and added to the trimmings for weighing with them. The strips were then spread on trays and blanched for 6 minutes in flowing steam at 209° to 212° F. Stripping, weighing, and spreading on trays were done as rapidly as possible, and the interval between cutting into strips and blanching was never more than 5 to 7 minutes. Upon removal from the blancher each lot of strips was divided into three portions: one was placed in the dehydrator without further treatment; one was dipped into 0.1 per cent orthophosphoric acid; and one was dipped into 0.1 per cent sulfurous acid solution made by dissolving SO_2 gas in water. The length of dip was in both cases 4 minutes. On removal from the dipping solution the strips were drained. spread on trays, and placed in the dryer. Drying was carried out in a laboratory dehydrator in a parallel-current air flow of 550 feet per minute. The temperature at outset of drying was 170° to 175°, which was reduced after 4 hours to 145° to 150°. The wet-bulb temperature was 120° at the outset of drying and 105° at the end. The material was removed from the drier when it had a residual moisture content approximating 7 per cent. A portion of each lot of material was placed in sealed glass containers and the remainder in heavy, closely woven bags. Both bags and sealed containers were stored at 70° F. until removed for examination and scoring.

Preparation Losses and Dry Yields

Table 1 presents for all the lots of material the data on the percentages of tubers rejected because of decay or diseaase, the losses in peeling and trimming, yields of prepared strips, and yields of dry product as percentages of raw whole stock.

In the inspection of the raw stock prior to peeling, any visibly decayed tubers were sorted out. After peeling, a second inspection was made for the purpose of removing decayed tubers and estimating the percentage of potatoes showing evidence of net necrosis, stem-end browning, or other abnormal conditions. The results of these inspections are recorded in two columns of the table. Decayed tubers or

those which showed general discoloration of most of the tuber were rejected, and hence are not included in the weights upon which preparation losses and dry yields were computed. Tubers that showed limited areas of discoloration or net necrosis, which could be removed by trimming, were not discarded, but the percentage of such tubers was determined for each sample.

The potatoes of both varieties that were dehydrated in December were almost wholly free of rot, less than 1 per cent showing decay. The material of Katahdin was entirely free of net necrosis or discoloration, and that of Green Mountain had less than .1 per cent of tubers showing net necrosis. After storage at 60° F. until the 16th of February, the Katahdin material was still free of stem-end browning and necrosis, but some lots had 1 to 4 per cent of decayed tubers, and others, while sound, had begun to develop numerous sprouts. The lots of Green Mountain material from the different farms differed very considerably in the amounts of rot and of net necrosis present, both of which were most severe in the material from the Davis farm and were almost equally bad on the lots with and without boron. In the potatoes from the other three farms, those from the plots receiving no boron in all cases had somewhat less rot than those from the boron-treated plots, and in two of the three they also had less net necrosis. The differences are small and have little significance further than that they indicate that boron had no effect in reducing the occurrence of net necrosis.

The losses in peeling for the various lots of the two varieties that were dehydrated in December ranged from 11.6 to 19.4 per cent, averaging 15.7 for all lots of Katahdin and 15.6 for those of Green Mountain. The losses in trimming ranged from 2.9 to 10.1 per cent, averaging 3.9 per cent in Katahdin and 7.1 per cent in Green Mountain. There were no indications that peeling and trimming losses were affected by the fertilizer treatments, as the differences between pairs of samples receiving the two treatments from the various farms were not consistent and are attributable to differences in average size, in smoothness of tubers, and in percentage of small tubers present in the various lots. The absence of any difference in effect of the two treatments is evident when the yields of prepared strips for the two treatments are averaged separately These averages were for Katahdin, 80.8 per cent for the non-boron lots and 79.9 for those with boron; for Green Mountain, 77.4 per cent for non-boron and 77.2 for those with boron. It may be noted that the over-all yields of prepared strips

were 80.3 per cent for Katahdin and 77.3 per cent for Green Mountain.

In the material dehydrated in February after storage for 2 or 2½ months at 60° F., the losses in peeling were slightly higher, averaging 18.4 per cent for each of the varieties. The increase in losses over those of the material prepared in December was due chiefly to increased resistance to the action of lye, requiring slightly longer treatment, and to the presence in some lots of varying numbers of sprouts that were removed in peeling. The trimming losses for Katahdin were very slightly higher than those for Katahdin in December—4.3 per cent instead of 3.9—, whereas in Green Mountain they had increased from 7.1 to 10.7 per cent as a consequence of the presence of varying amounts of net necrosis. The yield of prepared strips for all lots of Katahdin was 77.2 per cent and for Green Mountain, 70.8 per cent. Since peeling losses in the two varieties were identical in amount, the low yield of prepared strips in Green Mountain was due to the heavy trimming made necessary by the presence of net necrosis. As had been the case in the material dehydrated in December, there was no tendency for the boron-treated samples to run consistently higher or lower than the untreated checks in yields of prepared strips.

In the last two columns of the table, the yields of dry product are given as percentages of the fresh whole stock prior to preparation and also as percentages of the prepared strips. The yields as percentages of whole stock vary inversely as the losses in peeling and trimming, and hence show no consistent differences between the two treatments. The yields calculated as percentages of the weight of prepared strips are of course not affected by the losses in preparation, hence should indicate differences in solids content of the potatoes attributable to the differences in fertilizer treatments, if such differences existed. In the first dehydration of Katahdin, the average yield of the four lots receiving no boron was 18.6 per cent of the weight of prepared strips; that of the boron-treated lots 18.5 per cent. The yields from dehydration after storage were, with no boron, 18.1 and with boron, 19.8 per cent. In the case of Green Mountain, the yields at the first dehydration were with no boron, 20.5 per cent; and with boron, 20.1; and those at dehydration after storage were 21.8 and 21.9 per cent, respectively. The differences between the two treatments are smaller than those between lots receiving identical treatment but grown on different farms, making it clearly apparent that there were no differing effects of the two treatments on solids content.

Results of the examination of the data upon the occurrence of rot and net necrosis, peeling and trimming losses, and yields of dry product can be summarized by the general statement that the material receiving boron in the fertilizer showed no consistent or significant differences in any of these respects from that receiving no boron. This statement appears to hold for the results as a whole and also in detail for the material produced on individual farms.

The various lots of dry material were examined and compared during the drying, and as it was completed, for any differences in color or appearance that might be apparent between the varieties, the fertilizer treatments, or the potatoes from the different locations. No consistent differences attributable to location or fertilizer were found.

Examination and Grading of the Dry Products

Preparation and grading of the material for appearance and quality as cooked products were carried out from the 29th to the 31st of March, 1945. As there were two varieties receiving two fertilizer treatments in each of four locations, there were sixteen lots of material. As a portion of each of these was dried shortly after its receipt and the remainder after 8 to 10 weeks in storage at 60° F. and each lot was subdivided into three portions receiving different preparatory treatments before drying, the number of samples to be judged was ninety-six.

The samples were inspected and graded for color in the dry condition by matching the predominating color of each sample as closely as possible with the Maerz and Paul colors (8). Since there was frequently considerable variation in color among the pieces making up the sample and even between different portions of individual strips, matching was approximate rather than exact. The predominating color of the samples also varied considerably as a result of varying amounts of reddening, graying, or darkening, with the result that the colors found in the different samples ranged from 9 C 1 of the Maerz and Paul system through plates 10 and 11, with a few samples as dark as 12 D 2 and 12 E 2. The entire series was then graded numerically. Samples that had undergone no perceptible discoloration during or subsequent to drying and closely approximating 9 D 1 in color throughout were graded 1, those showing darkening, reddening, or graying were given lower numerical ratings, ranging fom 1.5 or 2 to 8, according to the degree of discoloration.

The material was refreshed by weighing out samples of 75 grams

into beakers, covering each sample with 225 milliliters of water and placing in a refrigerator overnight. The beakers were then set into a retort, covered so no evaporation could occur, and cooked in flowing steam for 40 minutes. They were then removed, placed on plates, given code numbers, and submitted to the judges. No salt or other seasoning was added, because such additions would have tended to mask differences in flavor.

Each of the cooked samples was graded upon the factors of color, texture or consistency, and flavor. In the grading, a scale of 10 was employed in which a score of 1 to 1.9 indicated high or excellent quality; 2 to 3.5, very good to good; 3.6 to 4.9, fair or acceptable; and scores numerically higher than 5, poor to very poor. After the scoring on the separate factors had been completed, each sample was given an over-all score on comparative desirability or acceptability. The scores of the various judges were then assembled and averaged.

As stated in the section on preparation of material, all potatoes were placed in a 1-per cent salt solution after peeling, and the strips were received into such a solution as they were cut and until they could be blanched. One complete series of samples was dehydrated without any treatment designed to prevent discoloration, whereas two such series received preventive treatment, one with orthophosphoric acid and the other with sulfurous acid solution. The comparative effectiveness of these treatments will receive some attention in a subsequent section. The primary purpose of the work was to determine any differences in the tendency to discoloration between the potatoes receiving boron in the fertilizer and those receiving none, and the presence of such differences, if they exist, would be evident in the samples receiving no treatment other than holding in salt solution between time of peeling and blanching. The results of examination and grading of this series are assembled in table 2.

The material of each variety is represented by four sets of samples from as many different farms, each set consisting of two pairs of samples. Each pair was made up of boron-treated material and a check receiving no boron. One of the pairs of samples in each set of four had been dehydrated shortly after receipt of the material at the laboratory, and the dry products had consequently been stored in air at 70° F. for 3½ months prior to examination. The potatoes from which the second pair was made had been stored at 60° for 8 to 10 weeks before being dehydrated, so that the dry samples had been stored in air at 70° for 6 weeks before being examined.

TABLE 2.—*Scores on color in dry condition and on color, flavor, texture and general desirability in cooked condition of dehydrated products made from Katahdin and Green Mountain*

TABLE 2.—*Scores on color in dry condition and on color, flavor, texture and general desirability in cooked condition of dehydrated products made from Katahdin and Green Mountain potatoes grown in four locations with and without addition of boron to the fertilizer applied, with averages for all samples for each variety under each treatment.*

Variety	Grower	Fertilizer Treatment	Date Dehydrated	Color Grade in Dry Condition	Ratings of Cooked Material			
					Color	Flavor	Texture	General Desirability
Katahdin	Brogdon	No Boron	12- 1-44	6.0	4.6	3.5	3.4	3.8
		Boron	12- 1-44	4.0	3.2	2.7	2.7	3.2
		No Boron	2-17-45	2.0	2.0	2.1	2.2	2.2
		Boron	2-17-45	2.0	1.8	2.4	2.1	2.2
	Coates	No Boron	12- 1-44	5.0	3.6	3.1	2.5	3.5
		Boron	12- 1-44	7.0	5.0	3.6	3.5	4.2
		No Boron	2-17-45	1.0	3.0	3.5	2.8	3.4
		Boron	2-17-45	1.3	3.2	2.8	2.5	2.9
	Davis	No Boron	12- 1-44	6.0	4.5	3.1	3.2	4.0
		Boron	12- 1-44	6.0	3.7	3.0	3.5	3.8
		No Boron	2-19-45	1.0	1.5	2.2	2.5	2.0
		Boron	2-19-45	1.5	1.5	1.9	2.7	2.0
	Hewitt	No Boron	12- 1-44	4.5	3.2	3.6	3.1	3.3
		Boron	12- 1-44	6.0	4.1	3.5	2.5	3.8
		No Boron	2-19-45	1.0	1.5	2.6	2.4	2.4
		Boron	2-19-45	1.6	2.6	2.4	2.7	2.6
Green Mountain								
	Brogdon	No Boron	12-18-44	3.5	3.0	3.1	1.7	2.8
		Boron	12-18-44	1.8	3.7	4.1	3.7	4.1
		No Boron	2-16-45	2.0	2.3	2.8	1.5	2.7
		Boron	2-16-45	1.5	1.8	2.5	2.2	2.3
	Coates	No Boron	12-18-44	3.0	3.9	3.2	3.0	3.7
		Boron	12-18-44	3.0	3.5	2.8	2.1	3.2
		No Boron	2-17-45	3.5	2.3	3.5	2.2	3.5
		Boron	2-17-45	2.0	2.8	2.8	2.1	2.8
	Davis	No Boron	12-18-44	4.0	4.2	3.0	2.7	4.2
		Boron	12-18-44	5.0	4.1	3.4	2.2	4.1
		No Boron	2-16-45	2.5	2.4	2.2	1.6	2.0
		Boron	2-16-45	1.5	2.5	3.5	2.5	3.0
	Hewitt	No Boron	12-18-44	8.0	7.0	4.7	2.7	6.0
		Boron	12-18-44	2.0	4.8	3.0	2.3	3.3
		No Boron	2-16-45	2.0	2.0	1.7	1.9	1.9
		Boron	2-16-45	2.0	2.0	3.5	2.4	3.2
Averages of All Samples								
Katahdin	Dehydrated 12/1/44	No Boron		5.4	4	3.3	3.0	3.8
		Boron		5.7	4	3.2	3.0	3.7
	Dehydrated 2/17-19/45	No Boron		1.2	2	2.8	2.5	2.5
		Boron		1.6	2.2	2.4	2.5	2.4
Green Mountain	Dehydrated 12/18/45	No Boron		4.6	4.5	3.5	2.5	4.2
		Boron		3.0	4.1	3.3	2.6	3.7
	Dehydrated 2/16-17/45	No Boron		2.5	2.2	2.6	1.8	2.5
		Boron		1.8	2.3	3.1	2.3	2.8

When the material was removed from storage for examination and grading it was apparent that the lots made in December, which had consequently been stored for 3½ to 4 months, had undergone varying amounts of darkening or reddening and were distinctly poorer in color than when first made. As previously stated, the various lots of material were examined and compared as drying was completed in order to detect any differences between them attributable to fertilizer treatment or location of growth. The material dehydrated in February was given a like examination as drying was completed. Even though no comparisons with the Maerz and Paul color standards were made on the freshly dried material at either drying date, the products made at the first drying were considered to be good to very good in color. At the time the second drying was completed the products were regarded as being generally slightly less good in color than the freshly made material from the earlier drying. Whether this were the case or not, there were clearly no such differences between the two lots of material when made as were apparent at the end of the storage period. In the material made in December, many lots were poor to very poor and unacceptable in color in the dry condition.

Inspection of the data in table 2 will show that the ratings of the samples made in December are with very few exceptions lower on all factors considered than those of the corresponding samples made in February. The differences in color in dry and cooked are largest and most consistent, those in flavor are somewhat smaller and less consistent, and those in texture small, not constantly present, and doubtfully significant. The ratings for all samples of each variety for the two fertilizer treatments and for the two drying dates have been averaged and the results included in table 2. They emphasize the differences in quality between the products made at the two drying dates, those made in February ranking collectively as very good; those in December as fair. The data warrant the conclusion that storage of the dried product in air at 70° F. for 3½ to 4 months had resulted in very considerable deterioration in color, flavor, and general desirability of all the material, regardless of variety, place of growth, or fertilizer treatment. Some change had doubtless occurred in the material made and stored in February, but it had not gone far enough to be apparent.

Comparison of the general averages for all samples receiving boron with those receiving none shows no significant differences attributable to fertilizer treatment in either variety or at either drying date.

In Katahdin dried in February, color was slightly poorer and flavor slightly better in the series receiving boron. In Green Mountain, dried at the same time, the exact opposite is the case. In neither variety do the series dried in December show the differences between boron and no-boron found in those dried in February. This compels the conclusion that the boron treatments had no effects upon color or flavor that were consistent and significant for all the material regardless of place of growth or treatment prior to drying.

The question whether application of boron might have had an effect upon one variety that did not occur in the other can be answered by comparison of the data of table 2. The general averages for Green Mountain show that the color of the dry products for both early and later dryings, was considerably better in the boron-treated material and in the early dried series this was also true for the cooked material. In the Katahdin material the boron-treated samples from only one of the four locations were better in color than those from the no-boron checks. In the material from the other locations, any differences in color between boron-treated samples and checks were generally in favor of the checks. This would seem to indicate that boron might have had some general effect upon the tendency to discolor in Green Mountain regardless of the location and soil but did not have any such general effect upon Katahdin. Since the material was grown in four different locations, there were presumably differences in character and composition of the soils and in the amount of boron already present, such that the effect of the added boron may have varied from farm to farm. If it were definitely beneficial or injurious in any given location, all the boron-treated samples from that location should be consistently better or poorer in color than the checks receiving no boron. Inspection of the data for the Coates, Davis, and Hewitt farms shows no such consistent difference. Of the four pairs of samples at each of the three locations, one of the boron-treated lots in each case was better in color and two were poorer than the corresponding non-boron lots, the remaining pair of samples showing no difference. In the case of the Brogdon farm, there are indications that the application of boron may have had some beneficial effect in reducing the tendency to discoloration in Katahdin as well as in Green Mountain. In the four pairs of samples, color in the dry condition was best in the boron-treated sample in three pairs and best after cooking in the remaining pair. This indicates a possibility that the added boron was of benefit to both varieties upon this particular soil.

It is unfortunate that the experiment did not include a series of

plots to which boron was applied in various amounts, both larger and smaller than that here used. It is definitely established that boron in small amounts is beneficial and stimulatory but that larger concentrations are injurious. The inconclusive results of this experiment make it appear probable that for these particular soils, the amount of boron added brought the total present above the range in which beneficial effects are evident with potatoes, yet did not raise it high enough to produce definite injury. More comprehensive experiments employing a closely graded series of applications, from a mere trace to amounts known to be very definitely toxic or lethal, and involving continuous observation of the plants throughout the season as well as detailed study of the mature tubers, will be necessary to determine the degree to which the quality of the tubers can be affected by application of boron.

Comparative Effectiveness of Preparatory Treatments in Preventing Discoloration

The study of this material afforded opportunity to obtain data upon the comparative effectiveness of orthophosphoric acid and sulfurous acid dips in preventing discoloration of potatoes in drying and deterioration in color and palatability in subsequent storage. In addition to the series of samples prepared without other treatment than holding in dilute salt solution after peeling, two series were prepared, one immersed for 4 minutes in 0.1-per cent orthophosphoric acid and the other for a like time in 0.1-per cent solution of SO_2 gas in water prior to drying. Comparisons between the three series of samples in the dry state and after cooking showed that the material dried without treatment other than holding in sodium chloride solution before blanching had darkened very little during drying but had subsequently undergone very considerable and general darkening during storage. Treatment with orthophosphoric acid had been fairly effective in preventing discoloration in drying and in storage but the material treated with it underwent considerable discoloration during refreshing and cooking. Dipping into sulfurous acid solution had effectively prevented any change in color throughout drying, storage, and cooking. There were no consistent or significant differences in texture as a result of the different treatments. Flavor in the orthophosphoric acid series was consistently slightly inferior to that of corresponding members of the salt-dipped series and rather markedly so in the case of the samples that had been in storage for the longest time. Many of the samples of

the series dipped in sulfurous acid and particularly those that had been most recently made retained sufficient SO_2 after cooking to be objectionably evident to taste, and the ratings on flavor were consequently not comparable with those of the other series.

Summary

Potatoes of the varieties Katahdin and Green Mountain, which had been grown in four locations in Maine under two fertilizer treatments, one containing boron at the rate of 7½ pounds per acre and the other containing none, were shipped to Beltsville, Maryland. A portion of each lot was dehydrated soon after receipt of the shipment in December, and the remainder was dehydrated after storage at 60° F. until mid-February.

No consistent differences between boron-treated lots and checks in respect to size, surface cracking, decay, stem-end browning, darkening of the vascular ring, net necrosis, or other defects could be seen in the raw stock, and there were also no consistent differences between them in amounts of losses in peeling and trimming, in tendency to discolor during preparation and drying, in appearance of the freshly dehydrated product, or in solids content and yields of dry product.

The products made at the first drying period were stored in air at 70° F. for 10 to 14 weeks, and those made at the second drying period were stored at the same temperature for 6 weeks prior to examination, cooking, and scoring. All the material stored at 70° F. for the longer storage period, regardless of fertilizer treatment or location in which it was grown, had undergone varying amounts of darkening or reddening during storage and was distinctly inferior in appearance as dry products to the material made later, hence stored for a shorter time. When the material was cooked, the older samples were very generally poorer in color and flavor than those more recently made. The lots made in February were rated as very good and those made in December as fair.

There were no consistent differences in color and flavor between lots of Katahdin from plots receiving boron and those receiving none. In Green Mountain the color of the dry products was on the average considerably better in the boron-treated lots than in the checks, but in most cases the differences largely disappeared when the material was cooked.

Insofar as could be determined from study of the fresh tubers and their dehydrated products, there was no evidence of any injurious

effects to either variety resulting from the application of boron to any of the four soils. For three of the soils there was also no evidence that its application was beneficial to Katahdin. On the fourth soil, discoloration in Katahdin, as well as in Green Mountain, was less in the samples receiving boron, indicating some benefit to both. It appears probable that for the soils used the amount of boron applied was below that necessary to produce definite injury but resulted in a total above what would induce consistent and unmistakable improvement over plants receiving none.

In a series of samples dipped in orthophosphoric acid or sulfurous acid solution prior to drying, discoloration during drying, subsequent storage, and cooking was entirely prevented by sulfurous acid. It was prevented during drying and reduced in amount during storage by orthophosphoric acid, but samples so treated underwent considerable darkening in the final cooking.

Lirerature Cited

1. Blair, A. W., and Brown, B. E. 1921. The influence of fertilizers containing borax on the yield of potatoes and corn,—season 1920. Soil Science 11:369-385.
2. Brown, B. E. 1922. Effect of borax in fertilizer on growth and yield of potatoes. U. S. Dept. Agr. Bull. 998, 8 pp.
3. Conner, S. D. 1918. The injurious effect of borax in fertilizers on corn. Proc. Ind. Acad. Sci. 1917: 195-199.
4. Cook, F. C. 1916. Boron: Its absorption and distribution in plants and its effect on growth. Jour. Agr. Res. 5(19):877-891.
5. ———— and Wilson. J. B. 1918. Boron: Its effect on crops and its distribution in plants and soils in different parts of the United States. Jour. Agr. Res. 13(9):451-471.
6. Dunklee, D. E., and Midgley, A. R. 1944. The need for borax on fourteen crops. Better Crops with Plant Food 28(7):15-19; 43-49.
7. Jones, H. A., and Brown, B. E. 1941. Plant-Nutrient Deficiency Symptoms in the Potato. Chap. IV in *"Hunger Signs in Crops,"* 327 pp.
8. Maerz, A., and Paul, M. Rea. 1930. A Dictionary of Color. 207 pp. 57 plates in color.
9. Miller, Edwin C. 1938. *"Plant Physiology."* Ed. 2, 1201 pp.
10. Morse, W. J. 1920. Some observations upon the effect of borax in fertilizers. Maine Agr. Exp. Sta. Bull. 288:89-120.
11. Meller, J. R., and Morse, W. J., 1921. Effects upon the growth of potatoes, corn and beans of the addition of borax to the fertilizer used. Soil Sci. 12:79-132.
12. Schreiner Oswald, Brown, B. E., Skinner, J. J., and Shapavalov, Michael. 1920. Crop injury by borax in fertilizers. U. S. Dept. Agr. Circ. 84, 35 pp.
13. Skinner, J. J., Brown, B. E., and Reid, F. R. 1923. The effect of boron on the growth and yield of crops. U. S. Dept. Agr. Bul. 1126, 31 pp.
14. Smith, Ora, and Nash, L. B. 1938. Effects of certain minor elements on chemical composition and cooking quality of potatoes. Proc. Amer. Soc. Hort. Sci. 35:530-533.

RESISTANCE OF POTATO TO VIRUS Y, THE CAUSE OF VEINBANDING MOSAIC

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Potato mosaic virus Y is the cause of veinbanding mosaic, one of the three major potato mosaic diseases. It occurs in the leading potato regions in America as well as in foreign countries. In many varieties it is responsible for greater reduction in yield than that caused by the other two mosaic viruses, A and X. In Green Mountain and similarly susceptible varieties, virus Y causes at least a 50 per cent reduction in yield whereas viruses A and X are each responsible for 15 to 30 per cent losses (1, 3, 5, 13, 14).

Virus Y causes a variety of symptoms in different varieties, ranging from light green and faint mottling to severe necrosis, curling, and dwarfing of the plants (8, 9, 10, 11, 12, 15). Virus Y in combination with virus X produces rugose mosaic, a more severe reaction on many varieties than that produced by a single virus.

Virus Y is easily transmitted by leaf rubbing and grafting as well as by means of the potato aphid (8, 9, 10, 15).

Tobacco, tomato, and certain other plants of the nightshade family are susceptible to virus Y.

Virus Y can be isolated and differentiated from viruses A and X by means of potato varieties that are susceptible to virus Y but immune from viruses A and X (11, 12, 13). Likewise some other nightshade plants, like Jimson weed, *Datura stramonium*, that are immune from virus Y but susceptible to virus X can be used as differential hosts. Furthermore, virus Y differs from virus A and X in filterability, ageing, dilution, and thermal inactivation (15).

Since disease-resistant plants are the most effective means of disease control, studies to determine the reaction of different potato varieties to virus Y were initiated several years ago. The results of these resistance tests are recorded in the following pages.

METHODS OF TESTING

To favor infection by means of aphids, potatoes were planted in hills that alternated with hills of a variety harboring virus Y. Each va-

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riety was represented by 10 to 20 hills. The Green Mountain variety served as a susceptible control. To supplement natural aphid infestation in the field viruliferous aphids of the species *Myzus persicae,* previously cultured on a virus-Y-harboring variety under cloth cages, were introduced into the test plots by depositing infested leaflets in the tops of all the plants. About four weeks before harvest the virus-Y-harboring tops in the field were cut off to induce aphid dispersal to the varieties under test.

At harvest, one tuber per hill was reserved for planting in the following season for readings on virus Y infection. Varieties that did not contract infection in the field test were subsequently exposed under cloth cages under heavy aphid infestation to test for immunity from virus Y.

The virus Y resistance tests were conducted on Aroostook Farm, Presque Isle, Maine, from 1937 to 1944.

As recorded in table 1, 720 potato seedling varieties representing five crosses and two selfed varieties were interplanted in the field with the virus-Y-harboring variety 42898, a late variety that carries the virus without conspicuous symptoms. Earlaine, Chippewa, Irish Cobbler, Katahdin, and 24642 are immune from virus A under field conditions and the variety 41956 is immune from virus X (11, 12). Furthermore, Katahdin and 24642 contract leaf roll less easily in the field than Green Mountain and other similarly susceptible varieties. Katahdin also shows some resistance to virus X. The various parent varieties were planted as controls and the Green Mountain served as the virus-Y-susceptible control. The potato seedling varieties and the parent controls were exposed during 1 to 6 consecutive seasons. The Green Mountain control contracted virus Y in every hill in one season and so virus Y free Green Mountain seed potatoes were introduced each year. Thirty-nine Katahdin selfed varieties that did not contract virus Y in two seasons in the field were exposed in cloth cages under heavy aphid (*Myzus persicae*) infestation to test for virus Y immunity.

The results from the exposure tests recorded in table 1 disclose that the virus-Y-susceptible Green Mountain control contracted virus Y in almost every hill whereas some seedling potato varieties from every cross or selfed variety did not become infected. Many of the infected seedling varieties contracted virus Y in only one or two hills of the 20 hills, which indicates that such varieties were less easily infected than the Green Mountain control or similarly susceptible varieties. Chippewa, Earlaine, Katahdin, and 24642 contracted virus Y less generally than did Green Mountain. Chippewa became infected less easily than the other varieties.

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TABLE 1.—*Resistance to virus Y of potato seedling varieties that were interplanted with Y seedling variety No. 42898. Aroostook Farm, Presque Isle, Maine, 1937 to 1942.*

Pedigree Number and Parentage	Seedling Varieties	Years Exposed	Exposure	Varieties Infected with Virus Y	Range in No. of Virus Y Hills for Infected Varieties
	Number			Per cent	Number
1241					
Katahdin selfed	102	1937-42	Field	93	1-20
Katahdin	10[1]	do	do	100	9-16
Green Mountain	9[1]	1 year	do	100	19-20
1241					
Katahdin selfed	39[2]	1939	Cages	90	
Katahdin	12 hills	1939	do	100	
Green Mountain	12 hills	1939	do	100	
1028					
Katahdin selfed	86	1939-42	Field	87	1-20
Katahdin	9[1]	1939-42	do	100	5-12
Green Mountain	6[1]	1 year	do	100	18-20
926					
Katahdin x Earl.	92	1939-42	do	90	1-18
Katahdin	7[1]	1939-42	do	100	1-7
Earlaine	7[1]	1939-42	do	100	1-7
Green Mountain	7[1]	1 year	do	100	17-20
455					
Chippewa x 24642	110	1939-42	do	85	1-20
Chippewa	11[1]	1939-42	do	9	1
24642	11[1]	1939-42	do	72	1-5
Green Mountain	10[1]	1 year	do	100	18-20
537 & 937					
41956 x Katahdin	44	1940-42	do	80	1-18
Green Mountain	4[1]	1 year	do	100	18-20
X336					
President x Kat.	90	1940-42	do	97	1-20
Katahdin	4[1]	1940-42	do	100	5-10
President	4[1]	1940-42	do	100	13-18
Green Mountain	9[1]	1 year	do	100	19-20
BI 1012					
Chippewa selfed	94	1942	do	59	1-19
Green Mountain	5[1]	1942	do	100	20
X203					
Irish Cob. x Kat.	102[3]	1940-42	do	91	

[1]Number of 20-hill replicates that served as controls.
[2]Varieties that did not contract virus Y in field in 1937.
[3]Dosed with *Myzus persicae* raised on virus-Y-harboring leaves of 42898 in 1940.

The parents and their progeny that contracted virus Y manifested a variety of symptoms ranging from light green, slightly rugose leaves to necrotic, curled, and severely dwarfed plants.

Among the progenies, 3 to 41 per cent of the seedling varieties did not contract infection. These are not necessarily virus Y immune but are highly field resistant. Some varieties that did not contract virus Y in the field became infected under more severe exposure to heavy aphid dosage under cloth cages. Even under this severe exposure a few varieties resisted more than one exposure before they became infected.

TABLE 2.—*Resistance to Virus Y of potato seedling varieties that were exposed to Virus-Y-harboring seedling variety No. 42898. Aroostook Farm, Presque Isle, Maine, 1943 and 1944.*

Pedigree Number and Parentage	Varieties	Years Exposed	Varieties Infected with Virus Y	Virus Y Infected Hills for Varieties	
	Number		Per cent	Number	Per cent
B 1043		1943			
Chippewa selfed	93	1944	65	1—8	28
Green Mountain	71	1944	100	10	100
B 205		1943			
Katahdin x 792-94	99	1944	91	1—10	52
Green Mountain	31	1944	100	10	100
B 1052		1943			
792-94 selfed	46	1944	85	1—10	57
Green Mountain	11	1944	100	10	100
B 208		1943			
1241-66 x 792-94	12	1944	83	1—6	28
Green Mountain	11	1944	100	10	100
B 209		1943			
1241-62 x 792-94	14	1944	71	1—10	62
Green Mountain	11	1944	100	10	100
B 210		1943			
792-133 x 1241-84	7	1944	57	1—10	35
Green Mountain	11	1944	100	10	100
BI 1012		1944			
Chippewa selfed	35[2]	in cages	40	1—2 in	30
Chippewa	14	do	43	6 hills	
Katahdin	15	do	100		
B 1043		1945 & 1946			
Chippewa selfed	50[3]	in cages	46		

[1]Number of 10-hill replicates that served as controls.
[2]Varieties that did not contract virus Y in the field in 1942 and 1943.
[3]Vareties that did not contract virus Y in the field in 1944.

In table 2 are recorded the results obtained from 271 potato seedling varieties, the progenies from four crosses and two selfed parents that were exposed to virus Y in the field for two seasons. Five parents, Chippewa, Katahdin, 1241-62, 1241-66, and 1241-84, are resistant to virus Y; and two parents, 792-94 and 792-133, are immune from viruses A and X (virus A is the aphid-transmitted component of mild mosaic and virus X is the cause of latent mosaic which is generally harbored by many commercial varieties). Fifty varieties from Chippewa selfed that did not contract virus Y in the field during two seasons were exposed under cloth cages to heavy aphid infestation.

As recorded in table 2, every hill of the Green Mountain controls became infected with virus Y. Though 57 to 91 per cent of the seedling varieties in the various progenies contracted virus Y, many of these varieties became infected less generally than did Green Mountain, whereas other varieties reacted like Green Mountain. The progeny of selfed Chippewa apparently resisted infection more than the progenies from the other parents. Some varieties that did not contract virus Y in the field became infected under heavy aphid infestation in cages.

Most of the infected varieties manifested necrotic and curled foliage whereas others developed only light green and rugose leaves.

Observations on the reaction of different potato varieties to virus Y show that some varieties are highly resistant, others readily contract infection, and many are moderately resistant, or intermediate between the highly resistant and least resistant groups.

Resistance apparently is not necessarily correlated with symptom expression, since some of the most resistant varieties manifest severe necrosis, curling, and dwarfing like that manifested by the least resistant varieties. Local necrotic lesions obtained by artificial inoculation have been reported to indicate virus Y resistance that is inherited from such necrotic parents (4, 6, 7).

Resistance to infection appears to be influenced by aphid dosage. Varieties that rarely contract virus Y in the field become generally infected when heavily infested with viruliferous aphids under cloth cages, as well as with heavy aphid dosage in the open field. This experience indicates the importance of developing varieties that are immune from virus Y. Field exposure that favors 100 per cent infection with virus Y on a susceptible control also favors 100 per cent infection of equally susceptible seedling varieties, but it does not necessarily disclose all of the less susceptible varieties in a single exposure test. Planting several replicates of a variety would be likely to reveal susceptibility in a shorter time than when a single replicate is used.

Seedling variety 24642, one of the parents of Chippewa and Katah-

din, contracted virus Y less generally than did Green Mountain. Also some of the progeny of 24642, Chippewa, and Katahdin are more resistant than the parents (2, 9, 6, 7).

A few varieties have not contracted infection although exposed to virus Y for several seasons. Additional infection tests with these varieties are in progress to determine whether they are immune from virus Y or merely escaped infection.

Summary

Veinbanding mosaic caused by virus Y is one of the three major mosaic diseases of potato. It occurs in the leading potato regions where it is capable of causing more than 50 per cent reduction in yield of susceptible varieties when it is widely spread by aphids. The leading commercial varieties are susceptible to veinbanding mosaic.

In combination with other viruses virus Y causes more severe injury than when it occurs alone. Since most of the commercial varieties harbor latent mosaic virus, such varieties on becoming infected with veinbanding mosaic manifest the severe reaction known as rugose mosaic.

Veinbanding mosaic is characterized by various symptoms ranging from slightly light green, mottled, and rugose leaves, to severely necrotic, curled, and dwarfed plants. The degree of these symptoms is influenced by the variety.

Studies on resistance of different potato varieties to virus Y show that varieties may be grouped as: 1, highly resistant, rarely contracting more than a trace of infection in the field; 2, moderately resistant, contracting 10 to 20 per cent of infection by plant count; 3, slightly resistant, contracting higher percentages of infection up to approximately 100 per cent; and 4, non-resistant, contracting practically 100 per cent of infection.

Resistance to infection by virus Y is affected by aphid dosage. Varieties seemingly resistant in the field are not necessarily resistant under heavy aphid infestation in cloth cages.

Virus Y resistance is heritable. A greater number of resistant seedlings are produced from highly resistant parents than from non-resistant parents. The progeny from resistant parents may be more resistant to virus Y than the parents.

Unless aphid vectors of virus Y are abundant, not all of the susceptible varieties are necessarily infected in a single season's exposure test.

LITERATURE CITED

1. Bald, J. G., and Norris, D. O. 1940. The effect of the latent virus (virus X) on the yield of potatoes. Jour. Coun. Sci. Indus. Res. Australia 8: 252-254.
2. Bawden, F. C., and Kassanis, B. 1946. Varietal differences in susceptibility to virus Y. Ann. Appl. Biol. 33: 46-50.
3. Bonde, R., Schultz, E. S., and Rawleigh, W. P. 1943. Rate of spread and effect on yield of potato virus diseases. Maine Agr. Exp. Sta. Bull. 421, 28 pp.
4. Cockerham, G. 1945. Some genetical aspects of resistance to potato virus. Ann. Appl. Biol. 32: 279-281.
5. Folsom, D., Schultz, E. S., and Bonde, R. 1926. Potato degeneration diseases; natural spread and effect upon yield. Maine Agr. Exp. Sta. Bull. 331.
6. Hutton, E. M., and Bald, J. G. 1945. The relationship between necrosis and resistance to virus Y in the potato. 1. Greenhouse results. Jour. Coun. Sci. Indus. Res. Australia 18: 48-52.
7. Hutton, E. M. 1945. The relationship between necrosis and resistance to virus Y in the potato. 2. Some genetical aspects. Jour. Coun. Sci. Indus. Res. Australia 18: 219-224.
8. Jones, L. K., and Vincent, C. L. 1937. The susceptibility of potatoes to the veinbanding virus. Jour. Agr. Res. 44: 69-79.
9. ———————, and Burk, E. F. 1940. The resistance of progeny of Katahdin potatoes to viruses. Jour. Agr. Res. 60: 631-644.
10. Schultz, E. S., Folsom, D. F. 1923. Transmission, variation, and control of certain degeneration diseases of Irish potatoes. Jour. Agr. Res. 25: 43-118.
11. ————, Clark, C. F., Bonde, R., Raleigh. W. P., and Stevenson, F. J. 1934. Resistance of potato to mosaic and other virus diseases. Phytopath. 24: 116-132.
12. ———————, Raleigh, W. P., Stevenson, F. J., Bonde, R., and Beaumont, J. H. 1937. Recent development in potato breeding for resistance to virus diseases. Phytopath. 27: 190-197.
13. ————, and Bonde, R. 1944. The effect of latent mosaic (virus X) on yield of potatoes in Maine. Amer. Potato Jour. 21: 278-283.
14. Scott, R. J. 1941. The effects of mosaic diseases on potaoes. Scot. Jour. Agr. 23: 258-264.
15. Smith, Kenneth M. 1937. A text book of plant virus diseases. 615 pp. illus. London.

SECTIONAL NOTES

COLORADO

As a result of the labor shortage, together with adverse weather conditions, some of the harvesting in Colorado continued well into the month of November. However, there was only a negligible acreage frozen in the ground. The market has been quite active with the shipments of Red McClures running ahead of the same dates last year. About one-half of the Red McClure crop has already been shipped. Eighty-four per cent of these shipments have been U. S. No. 1 and 35 per cent have been washed.

Colorado will have about the same amount of seed potatoes this year as last. Although the acreage entered for certification was less

than in 1946, the rejections were considerably less with the result that about the same acreage passed the final inspection. There may be a definite seed shortage next spring. The prevailing market prices have caused a few growers to sell their certified seed as table stock. Should any large amount of certified seed be sold as table stock, the supply will be very short next spring. Inquiries for certified seed have increased within the last month so this danger may be largely eliminated. However, the early areas which are normally heavy purchasers of certified seed sold a large part of their crop in July and August at Government support prices. These low returns for the early crop are not inducive to large investment for the next crop. (Dec. 3).—CECIL W. FRUTCHEY.

FLORIDA

The planting season in the Homestead section is very late because of flood conditions in farm lands resulting from the excessive rainfall during October. Soil conditions are slowly improving but much of the land is still too wet for working and it may be the 15th of January before planting is completed.

Growers had planned to plant about 6,000 acres this year. Approximately 60 per cent of this was planted by the 1st of December with prospects for a poor stand in many fields. There was considerable seedpiece decay in the early plantings, which made it necessary to replant many fields, and this may reduce the final acreage to less than 5,500.

Approximately 55 per cent of the acreage will be planted to Pontiacs with Bliss Triumph accounting for practically all of the remainder. A few Sebagos are being planted.

Late blight has not as yet appeared on potatoes. It has, however, been found on some lots of potato seed shipped into the area, and has been reported in tomato seedbeds. This report has not been confirmed by personal observation. (Dec. 2).—GEO. D. RUEHLE.

KENTUCKY

Killing frost came on the 4th of November, fully three weeks behind schedule. By that time, Irish Cobbler vines had been dead several weeks. Because of a dry season, the Cobblers yielded only 125 bushels per acre, but the quality and seed-size were good. A total of eleven acres was certified.

In contrast, frost found Sequoia's vines still green, this variety being capable of withstanding dry weather and then resuming growth. The yield was 240 bushels per acre; the quality is excellent but many over-size tubers need to be culled for certifying. Fifteen acres were

certified. It is the growing belief among Jefferson county's potato men that Sequoia may well be grown for winter tablestock use, as it has consistently yielded more than 225 bushels per acre, for the past four years.

Sebago, of which one acre was certified, suffered because of dry weather, therefore the vines died early, making only 125 bushels per acre. We are not sure that Sebago is for Kentucky, but its brightness and general attractiveness are intriguing. (Dec. 12).—JOHN S. GARDNER.

MAINE

The potato market right now is in the doldrums. The Government stopped their purchasing program the last of November. The increased price support for December has resulted in practically no market. The Government had purchased about 2500 cars, most of which have gone into storage. It is expected that they will start purchasing again within a few days for the Government realizes that practically every farmer in Maine is entitled to price support. Contract dealers cannot operate under the low price for they have agreed to pay the farmer at least support prices. This makes a serious situation. Most folks agree that if the Government comes back into the picture the market should be strengthened.

The Extension Service, State Department and Shippers Committee are receiving the backing of the industry in a new seed program. The idea is to get every farmer in the state to plant only Certified Blue Tag seed. They have adopted a slogan:

"If you are shooting
For highset yields
Use Blue Tag Certified
On all your fields."

The object is to eradicate ring rot and if all seed can be replaced by certified seed outstanding progress should be made in eradicating the disease. The tax committee has voted approximately $2,000.00 to be expended on posters and stickers. One of the big production problems this year with many growers is frosted ends with the Katahdin variety. This is especially true in the northern section of the County. Farmers are still having trouble keeping Katahdin under ground. Many times they either sunburn or are touched by frost because they set so near the surface. A campaign will be forwarded next year to induce farmers to hill Katahdins very late in the season so that they will be deep enough to avoid sunburn and frosted ends.

Maine, of course, has what is generally known as a "high ridge" although Aroostook folks term it a "medium ridge hill".

P.M.A. is holding election meetings in 28 Aroostook communities. A discussion of a long term program for the potato industry will be led by a few industry leaders. It is expected that the subject of marketing agreements will be proposed. An expression will be secured at the meeting to learn if farmers are interested enough to request that a proposed marketing agreement be brought up for consideration.

Certified seed growers are feeling optimistic. We expect to ship one of the finest crops ever grown. Our virus diseases are thought to be extremely low and the general appearance is very good. The weather during harvesting was good so most of our potatoes are bright and clean. (Dec. 5).—VERNE C. BEVERLY.

NEBRASKA

The movement of potatoes, seed or table, in Nebraska is considerably behind schedule for this time of year. Although the estimate of production has been reduced 25 to 30 per cent as compared with a year ago, shipments to date, are lower than that proportionately. One of the chief factors retarding shipments, has been the reluctance of growers to sell at current prices being offered by shippers. Shippers, in turn, contend that they are unable to pay higher prices for potatoes because of outside market resistance. Many people seem to feel that there will be more potatoes offered after the first of the year, on the theory that some of the reluctance of farmers to sell is due to the high income bracket in which they already find themselves. Without a doubt, this has some bearing on the situation.

Certified seed potatoes have been moving to the lower Rio Grande valley of Texas for more than a month, and such shipments will probably be completed very soon. Other territories will not begin taking their seed until early January. This includes Louisiana, Alabama, Mississippi and Florida.

Test samples of all certified seed lots grown in Nebraska and Wyoming have been shipped to Los Fresnos, Texas for planting on the 15th of December. Readings of the test plot during February, will give a preview of the quality and disease freedom of seed to be planted for certification in 1948. Lots found to contain too much disease must be replaced with better stock that will qualify as foundation seed, in order to be eligible for certification. (Dec. 5).—MARX KOEHNKE.

New Jersey

Potato growers in New Jersey have placed very few potatoes in storage and have therefore made very few carlot shipments during the winter months. They have been busy repairing and remodelling buildings, reconditioning machinery, and also plowing in preparation for next year's crop.

Many rumors continue to be circulated among the growers in connection with the reduction in potato acreage goals to be recommended for New Jersey by the Department of Agriculture in 1948.

To date no definite figure has been released by P.M.A. and growers are still wondering if the reduction will be 15-20 or 40 per cent. These figures have been rumored wherever potato growers gather. Latest indications point to a return to the original direction that no reduction in acreage will be requested. If this is so the government is probably assuming that there will be foreign demand for our potatoes again next year, that yields will likely be lower or that a large supply will discourage high prices. There may also be a possible change in the method used to determine parity which will result in lower prices to the consumer. We should know definitely what the goals will be as soon as reports are released from the meeting at Colorado Springs. (Dec. 12).—John C. Campbell.

New York

Reports from several sources indicate that some potatoes are not coming out of storage as well as expected. A hot period following a period of low temperatures which produced some field frost seems to be the cause. The size and quality are reported good otherwise.

More than 90 per cent of Central New York potatoes are going to market in consumer packages. The demand seems to equal or exceed the supplies at times and growers who are in the program are making money.

Some growers are worried about the 1948 crop and the effect of cessation of support on December 31. Being late potato producers with storage facilities they are concerned about prices, should the crop be large. This feeling will probably reduce the acreage and it is hoped that the situation will take care of itself.

The quantity of available certified seed is lighter than usual and growers are holding for a strong spring market. Fall sales were at a minimum because of the shortage of storage. (Dec. 4).—H. J. Evans.

Oregon

Our growers have indicated that they expect to plant more potatoes than in 1947. The quantity of high quality certified Russet seed available may have been an important factor. Shipments of our 1947 crop to date are approximately 60 per cent that of 1946. Our seasonal shipments are generally estimated at about this rate, possibly a few per cent higher.

Our growers generally speaking, are in favor of a limited acreage and some type of support. This area is under marketing agreement that has not yet been used. We believe this form of maintaining prices would be satisfactory if undergrades could be withheld from the market during years of surplus. It is also our opinion that a support level insuring regular potato growers cost of production plus a reasonable profit be adopted. The diversion of potatoes for processing and livestock feeding is believed to be very helpful. Our growers are still attempting to establish a processing plant for starch manufacture. The large plant we now have has operated in a small way but is at present closed because of financial difficulties. (Nov. 25). —C. A. Henderson.

Washington

There were 1,111.8 acres of potatoes certified in Washington during the past season of which 895.5 acres were White Rose. Our estimated total yield of certified seed was 394,941 bushels. For several years our total number of certified acres has declined. However, the quality of the seed stock has improved. This is indicated by the results of this year's field inspections when only 24 acres were disqualified for virus diseases during the entire season.

The entire White Rose crop at this time has been sold. The seed has been in excellent demand. The 1946 seed has given excellent results and buyers are very anxious to place orders for their 1948 seed supply. (Nov. 26).—Harold S. Schaad.

Canada

Harvesting operations in Prince Edward Island were completed by the first of November. Shipping has continued steadily, but there has been a shortage of railway cars, which has made it difficult to fill orders that were already accepted. Every available warehouse and building which could be used for storage was being filled. Representations have been made to the railway authorities in an effort to obtain more cars, so that more of this stock could be shipped to its

ultimate destination. It is anticipated that arrangements will be made shortly to overcome these difficulties so that delivery may be made of seed which is now on order.

The total production of certified seed potatoes for this year in Canada is estimated at 11,747,000 bushels. Of this amount, 994,900 bushels are estimated to be of the Foundation grade; 4,342,000 of the Foundation A grade; and 6,410,100 of the Certified grade. These are, of course, preliminary figures, and subject to revision. The more important varieties produced are as follows: Green Mountain, 3,387,700 bushels; Katahdin, 3,364,100; Irish Cobbler, 2,392,300; Sebago, 1,423,000; Netted Gem, 463,100; and Bliss Triumph, 421,500. The greatest total production was, of course, in Prince Edward Island, where the seed potato crop is estimated at 6,100,300 bushels. New Brunswick is second, with an anticipated production of approximately 3,980,000 bushels.

It will be noted that these figures are slightly higher than those for 1946, when the total production for all Provinces was 10,855,400 bushels, that for Prince Edward Island 5,886,600; and for New Brunswick 3,641,000.

The Irish Cobbler variety has dropped from second to third place in production, being replaced by the Katahdin variety, whereas Bliss Triumph has dropped from fifth to sixth place, its place being taken by the Netted Gem variety. (Dec. 1).—J. W. SCANNELL.

PROVINCE OF ONTARIO

A good demand prevails for seed and table potatoes. Prices have strengthened during recent weeks, with No. 1 table stock, on Toronto market the lowest for Province quoted today (December 3rd) is at $2.50 to $2.65 per 75 pound bag, wholesale to retail. Growers feel they should receive from $.50 to $1.00 per 75 pound bag premium for Foundation A seed stock. Our 1947 lists of seed growers are now available from the Department.

The potato show at the recent Royal Winter Fair, Toronto, was regarded "as the biggest and best ever held in Canada, far surpassing any previous exhibits". All provinces were well represented, with Grand Championship being awarded to Ross Bros., Pemberton, British Columbia on 30 potatoes of the Netted Gem variety. Joseph Gattie, of Watford, Ontario, was reserve, for his exhibit of Chippewa Variety.

Three growers from Ontario, have obtained record yields for the province, namely, Fred Sohm, Magnetawan, 718 bushels per acre; C. H. Chapman, Nipissing, 694 bushels; and Frank Rick, Trout Creek, 693 bushels. Mr. Rick won a trophy and $250.00 in cash, for high score in quantity, quality and exhibit. (Dec. 3).—R. E. GOODIN

RECORD POTATO YIELDS

The report that R. C. Zuckerman of Stockton, California, produced 1,188.2 bushels, or 719.9 hundred-pound sacks per acre has created considerable interest in the potato world. This yield was obtained on a measured acre, one of five on Mandeville Island, near Stockton, groomed carefully for the record test. The potatoes were of the White Rose variety, planted on the 15th of March, and grew for 147 days. They were planted in rows 28 inches apart and spaced 8 inches in the row. Many of the potatoes weighed as much as 3½ pounds each. Fourteen hundred pounds of fertilizer were used. The field was irrigated by subirrigation with ditches every 12 rows. The land had been in pasture for the past four years.

The yields were checked by County Agricultural Commissioner Austin Mahoney and County Inspector George Stipe.

Upon receipt of this news, R. J. Haskell and F. J. Stevenson of the U. S. Department of Agriculture did some checking concerning previously reported record yields. They found several reports of yields in excess of 1,000 bushels but the largest was slightly less than that made by Mr. Zuckerman, who broke his own record.

The yields reported below are, of course, for the United States only. There may be higher yields but until evidence is produced, the crown belongs to Mr. Zuckerman.

Wallace MacFarland, in the December and January 1933-1934 issues of *Better Crops with Plant Food,* describes the world record potato crop of 1,155.8 bushels per acre grown on Weyl-Zuckerman & Company farm at Stockton, California. Ten sacks of seed potatoes were used per acre, and these were spaced ten inches apart in 30-inch rows. The seed bed was prepared with a pulverizing machine, and 1,000 pounds of 0-15-12 fertilizer were applied per acre. Fertilizer was applied 2 inches below the seed pieces over a width of 10 inches and was thoroughly mixed with the soil to a depth varying from 8 to 10 inches. The crop was planted on the 1st of April and harvested on the 18th of September, 1933.

Western Farm Life 31 (22): 3 (Nov. 15, 1929) reports that L. G. Schutte of Monte Vista, Colorado, raised 1,145 bushels per acre of Brown Beauty. He used 6- to 7-ounce tubers planted whole. They were planted at a depth of 6 inches, 1 foot apart, in rows 34 inches apart. Alfalfa sod land was plowed 14 inches deep in the spring of 1928 and planted to potatoes. In the spring of 1929 about 15 loads of manure were applied per acre and land plowed 10 to 12 inches deep.

Western Farm Life, Oct. 15, 1931, p. 2, states that John Gredig

of Del Norte, Colorado, produced 1,069.06 bushels per acre of Bliss Triumph in 1931. He planted whole seed, treated with an organic mercury compound, planting 1,400 pounds of seed per acre. He planted at a depth of 6 inches. The land was black bottom in which lettuce had been planted in 1928, 1929, and 1930, and in which native hay had been grown 20 years previously. This was plowed to a depth of 10 inches.

Western Farm Life, Vol. 30, 1928, has recorded that in 1928 Mr. L. G. Schutte of Monte Vista, Colorado, raised 1,047.5 bushels of potatoes on one acre. The variety was Brown Beauty. This crop was grown on land that had been in alfalfa for several years. Forty tons of manure were applied, and hand-selected seed was used.

The New England Homestead, Vol. 110, 1937, indicates that in 1889 Mr. Philo Reed of Fort Fairfield, Maine, harvested 745 bushels per acre.

The Farquhar Iron Age *Farm News,* April, 1947, points out that Mr. Jacob K. Mast, Caernaron Township, Lancaster County, Pennsylvania, harvested in the fall of 1946, 734.07 bushels per acre of the variety Sequoia. All plants were spaced 10 inches in the row and the rows were 32 inches apart. Mr. Mast used 1,000 pounds of 4-12-12 fertilizer.

The New England Homestead, Vol. 110, 1937, records a statement that Frank R. Shaw of Presque Isle, Maine, harvested 701 bushels per acre of Chippewa.

We would like to add one more report to the above list. In New Jersey this year, a yield of 754 bushels per acre was produced in a variety test plot on the farm of Oscar Ketcham, Jr. of Freehold. These potatoes were of the Chippewa variety. They were planted on the 28th of April and harvested on the 6th of October. A wheat cover crop on which 1000 pounds of 4-12-8 fertilizer had been broadcast was plowed down in the spring and 1200 additional pounds were applied in bands at the time of planting. The yield was officially checked by Mr. Richard O. Rice, the Associate Agricultural Agent in Monmouth County.

It is true that this does not approach the 1188.2 bushels produced in California but New Jersey is a much smaller state!

POTATO RESEARCH IN PERU

A study of potatoes in southern Peru is of exceptional interest because the parent stock for varieties now grown throughout the world is believed to have come originally from this region. Together with

Chile, Peru is regarded as the native home of the wild potatoes which were first domesticated by Indians antedating the Inca civilization.

Centuries of cultivation in high mountain valleys with little intercommunication have developed numerous varieties in southern Peru, and in addition there are many of the wild species of the genus Solanum, and varieties of the species *S. tuberosum.* Although botanists and plant explorers have made occasional trips to Peru for collection, classification, and introduction of these potato plants, it appears that only a beginning has been made in exploring the economic possibilities of plant material in the region. A chief problem has been the absence of satisfactory botanical collections from which agriculturists could make selections for yield, disease resistance, table quality, appearance, and other economic properties.

Two botanical collections of potatoes are now being established which will be of considerable interest to plant breeders in all countries. One collection is that of Dr. Cesar Vargas C., professor of botany in the Universidad de Cusco, located in the mountain city of Cusco, Peru. The other is that of the Estación de Experimentación Agrícola de la Molina, on the outskirts of Lima.

Since 1939, Dr. Vargas at Cusco has been collecting and propagating domesticated and wild varieties within the high mountain valleys, where potatoes are indigenous at altitudes of 11,000 to 14,000 feet. From approximately 850 clones collected for special study. Dr. Vargas has described more than 300 species and varieties. Herbarium specimens are kept on file for each of the plants studied, and about 200 clones are propagated annually for botanical observation and study. The collection at present is a little difficult to use because of the lack of uniformity among botanists in classifying species and varieties of potatoes, but this may be remedied by further research and comparison. Dr. Vargas follows a European system (Juz. et Buk) which classifies numerous separate species of edible *Solanum* tubers, differing from the United States practice of classifying most edible potatoes as varieties within the single species *Solanum tuberosum.*

The annual propagation of clones at Cusco so far has been confined only to botanical observation, as Dr. Vargas does not have funds for work in experimental plots. By far the most numerous of the clones are those cultivated by small subsistence farmers for home consumption, with small tubers and low yields, but these have possible value with respect to disease resistance or other factors. The collection will provide especially valuable source material for other workers who visit the Peruvian sierra in search of native potatoes, and who have the resources to develop projects in selection and genetics. Potatoes in the sierra pro-

duce viable seed, and the collection therefore provides opportunity not only for clonal selections but also for selecting and hybridizing seed to establish genetically stable lines.

At La Molina near Lima, the Peruvian Ministry of Agriculture is propagating plots which include clones from both the sierra and the coast with the objective of testing them under coastal conditions where disease is a particularly serious problem. Over 400 clones are now being observed preparatory to making selections primarily for yield and for disease resistance. An immediate objective of this work is the determination of the best clones for a certified seed program under which seed will be brought down annually from the sierra, to be used on the coast where disease prevents maintenance of good seed supply. From the research point of view, however, disease conditions impede the establishment of a permanent botanical collection at La Molina comparable to that which can be maintained in the Cusco region. (Oct. 1947). —AMERICAN EMBASSY, LIMA, PERU.

SAN LUIS VALLEY MARKETING AGREEMENT

WILBUR G. ERICKSON,
Manager San Luis Valley Potato Board of Control

Most of the inquiries that come to us relative to the Colorado Marketing Agreement established by House Bill 738, Session Laws of Colorado 1839, and in particular the agreement set up for the five counties in the San Luis Valley that produce Red McClure potatoes, are (1) How is the agreement instituted in the state? (2) Can it be operated by state or local areas? (3) Is it flexible enough to accomplish the objectives of a changing industry? (4) Does the agreement have "teeth"—can the orders be enforced and assessments collected?

The agreement is presented the General Assembly by Representatives and Senators acting on behalf, and at the request, of producers in the state. Usually there is no opposition to its enactment, as the Act becomes effective, and it is placed in operation only after a majority of the handlers and producers in a defined area signify their willingness to regulate the shipments of their produce by the casting of ballots at a duly scheduled and advertised election. In other words the Act is in the Statutes for any group or district that desires to take advantage of it. At the present time Colorado State Marketing Agreements are being used by the peach producers on the Western Slope; by Mesa County pear growers, and by Red McClure potato growers in the San Luis Valley.

The Marketing Agreement may be operated statewide where commodities are produced in various parts of the state, or they may be organized on an Area basis and boundaries defined by counties where production is localized. Only five counties in Colorado produce Red McClure potatoes commercially, and all of them are situated in the San Luis Valley. All the commercial peaches in Colorado are produced in two or three counties in Western Colorado, and Mesa County produces practically all the pears shipped from the state. A marketing agreement on Green Pod Peas or head lettuce would have to be statewide as these commodities are grown in various parts of the state, however, a State Agreement on cauliflower could be localized in about two counties.

The Colorado Act is flexible. It is administered by the Colorado Director of Agriculture who sets up the various boards of control, supervises the election and appoints board members, issues regulatory orders that are recommended by the boards of control, provided always that they are for the benefit of the industry and that no grower will be denied rights and benefits that are available to other growers in like conditions or under similar circumstances.

Under the Act, growers, through their Board of Control can regulate shipments, establish grading standards of quality, condition, size or pack for any agricultural commodity. They can promote the sale of their commodity through advertising and sales promotion plans. They can eliminate or regulate "loss selling" by requiring the vendor to post prices, and they can require that all containers be branded with the grade and commodity, and that the net weight of the contents be clearly shown. In short the grower is not only permitted to build up the industry in which he is a producer, but he can protect that industry from unscrupulous growers and distributors who might take the short instead of the long view on what is best for the majority.

The rate of assessments can vary according to the work that is intended to be accomplished, but funds collected for a specific purpose must be used for the accomplishment of that purpose only, and any surplus remaining in the treasury at the close of the season must be prorated back to the grower who paid the assessment.

Here in the San Luis Valley an assessment of 1 cent per 100-pound bag of potatoes is collected and allocated on the basis of approximately ¼ cent for administration; ¼ cent for advertising, and ½ cent for improvement work consisting of research work in eliminating disease and insects and improving the quality at the producer level.

The Colorado Director of Agriculture has issued three orders this season at the request of the San Luis Valley Potato Board of Control. (1) An order setting the rate of assessment at 1 cent per 100-pound bag

of potatoes. (2) An order prohibiting the shipment of immature Red McClure potatoes between the 2d of September 1947, and the 16th of October, 1947. (3) An order prohibiting the shipment of potatoes in containers that are not clearly marked and branded with the correct net weight when packed.

The Colorado Marketing Agreement does have "teeth," and where an agreement is instituted by a majority of the growers, all orders can be enforced through the office of the Attorney General of the state. Where grades or packs of various commodities are shipped in violation of existing orders, the Attorney General can issue a restraining order, and prosecute the offender according to the enforcement provisions contained in the Act. However marketing agreements like all other businesses are based on good will, and a policy of speaking softly is important but it must be backed up with a big stick.

It appears now that marketing agreements, whether Federal or State, will become a very important part in the development of the potato industry, and of course these agreements can overlap with Federal Agreements embracing large production areas consisting of several states, and State local agreements performing a more flexible function of assisting the grower in producing better quality, and making available to him the services of various technicians that can visit his farm and help to solve his problems. Many problems of production arise that can not be solved on the farm by individuals, but collectively they may have the problem solved for them.

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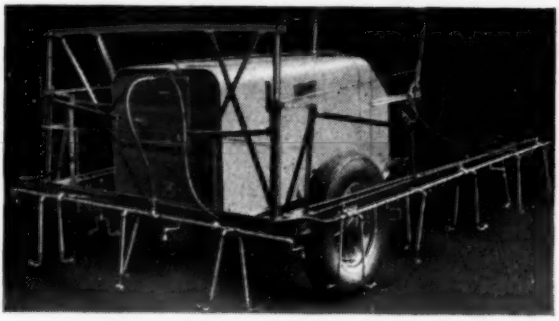

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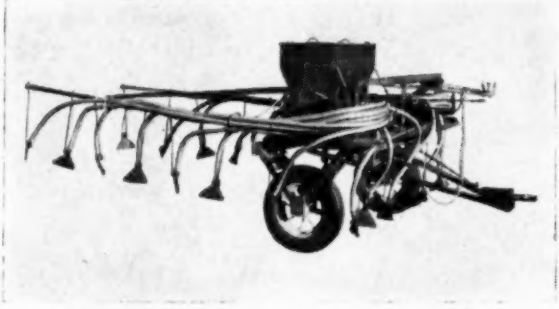

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